International Journal of Medical Informatics 87 (2016) 44–53

Contents lists available at ScienceDirect

International Journal of Medical Informatics

journal homepage: www.ijmijournal.com

Factors affecting physicians' use of a dedicated overview interface in an electronic health record: The importance of standard information and standard documentation

Lotte Groth Jensen[a,b,*], Claus Bossen[a]

[a] School of Communication and Culture——Digital Design and Information Studies, Aarhus University, Denmark
[b] CFK—Quality Improvement & Public Health, Central Region Denmark, Denmark

ARTICLE INFO

Article history:
Received 29 June 2015
Received in revised form 9 December 2015
Accepted 11 December 2015

Keywords:
Information visualisation
Electronic health record
Clinical overview
Standard documentation
Health care
Qualitative research

ABSTRACT

Background: It remains a continual challenge to present information in user interfaces in large IT systems to support overview in the best possible way. We here examine how an electronic health record (EHR) supports the creation of overview among hospital physicians with a particular focus on the use of an interface designed to provide clinicians with a patient information overview. The overview interface integrates information flexibly from diverse places in the EHR and presents this information in one screen display. Our study revealed widespread non-use of the overview interface. We explore the reasons for its use and non-use.

Method: We conducted exploratory ethnographic fieldwork among physicians in two hospitals and gathered statistical data on their use of the overview interface. From the quantitative data, we identified where the interface was used most and conducted 18 semi-structured, open-ended interviews framed by the theoretical framework and the findings of the initial ethnographic fieldwork. We interviewed both physicians and employees from the IT units in different hospitals. We then analysed notes from the ethnographic fieldwork and the interviews and ordered these into themes forming the basis for the presentation of findings.

Results: The overview interface was most used in departments or situations where the problem at hand and the need for information could be standardized—in particular, in anesthesiological departments and outpatient clinics. However, departments with complex and long patient histories did not make much use of the overview interface. Design and layout were not mentioned as decisive factors affecting its use or non-use. Many physicians questioned the completeness of data in the overview interface—either because they were skeptical about the hospital's or the department's documentation practices, or because they could not recognize the structure of the interface. This uncertainty discouraged physicians from using the overview interface.

Conclusion: Dedicating a specific function or interface to supporting overview works best where information needs can be standardized. The narrative and contextual nature of creating clinical overview is unlikely to be optimally supported by using the overview interface alone. The use of these kinds of interfaces requires trust in data completeness and other clinicians' and administrative staff's documentation practices, as well as an understanding of the underlying structure of the EHR and how information is filtered when data are aggregated for the interface.

1. Introduction

Searching for data and creating an overview of data in information-intensive environments such as hospitals can prove a challenging task. Clinicians spend much time seeking and examining data about their patients in order to integrate these data with their overall medical knowledge. They may find it difficult to create a quick overview of patient information and may therefore overlook vital information [1]. In hospitals, the patient record or the health record is often the primary information source. The organization and the presentation of data in health records is therefore critical for information seeking and for the creation of overview [2–4]. In recent decades, many hospitals in Europe and North

* Corresponding author at: CFK—Quality Improvement & Public Health, Central Region Denmark, Denmark.
E-mail addresses: lotte.groth@stab.rm.dk, imvcb@hum.au.dk (L.G. Jensen).

http://dx.doi.org/10.1016/j.ijmedinf.2015.12.009
1386-5056/

America have replaced their paper-based health records with electronic health records (EHR). This technology shift poses new challenges and offers new ways to present health record data and to create an overview of patient cases. The organization, presentation and quality of data in EHRs are therefore also critical to patient care and affect both the standard and the continuity of patient care. Häyrinen et al. argue that the success of an EHR system depends largely on the quality of the information available to health care professionals when making decisions about patient care [5].

One solution to the challenge of presenting data is to design a dedicated overview interface. Greene et al. argue that "an effective overview provides users with an immediate appreciation for the size and extent of the collection of objects the overview represents, how objects in the collection relate to each other, and, importantly, what kinds of objects are not in the collection" [6,p. 381]. An important aim of many attempts to visualize information is to provide a compact representation of information that enables users to think about the information and navigate through the entire information structure [7].

Research into the design and use of interfaces often rests on an experimental study design in which a hypothesis is raised and different variables are defined as dependent or independent. This type of research (which includes laboratory studies and usability tests) has recently been supplemented with detailed ethnographic research conducted in the context of everyday users' working practices [8]. Hornbæk & Hertzum claim that it is important to investigate the working practices that lead to the creation of an overview rather than to understand overview as simply a passive reception of information. Overview, they argue, is not a separate task that exists in isolation; instead, "overview is intertwined with the purpose for which the overview is useful" [7,p. 519].

We performed an observational study of an attempt to visualize patient information in a dedicated overview interface in hospitals in the region of Central Denmark. We studied the creation of overview and focused on the processes taking place in the transition from a paper-based health record to an EHR. Particular attention was also paid to the creation of overview of patient cases or patient histories. The new EHR had a dedicated overview interface that could be flexibly designed and configured depending on the particular departments' needs. Observations were conducted 6 months after the implementation of the EHR. After several days of observations and interviews with physicians, it became clear that very few of them were using the interface to create an overview of patient cases and patient histories. Having discovered this, we then consulted statistical information (from the production environment) to establish to which extent the overview interface was used at all; next, we interviewed the physicians to examine the reasons for their use or non-use of the overview interface. By studying the use of the interface in daily clinical practice, our focus shifted from layout and design to issues of documentation practice and the use of standard information.

This paper will start with a brief presentation of overview interface research before outlining the basic theoretical concepts that underlie our understanding of the creation of overview. Next the overview interface under study and the methods used in the study will be described. Following this, we will outline the reasons for use and non-use in different departments and present the relevant underlying factors. The paper will conclude with a discussion of the implications of the results.

2. Overview interface research

Overview interfaces or information visualization can be designed for various purposes and for various domains. An important objective of many of these overview interfaces is to provide a compact representation of the underlying information space to help users think about and navigate this information. Some studies on information visualization seem to assume that the mere provision of an overview interface will ensure the successful creation of overview and, as such, these studies disregard the process of interpretation and understanding [7]. Besides this, Cookburn et al. conclude that overview interfaces should be designed to support the completion of specific tasks [9].

Within the field of health care, information in EHRs is generally presented in many different ways to facilitate the creation of overview among clinicians. Clinicians can usually switch between reading data about the patient and seeing some of the same data presented in different interfaces in which pieces of information from different sources are juxtaposed (for example, all prescriptions, all MR scans, or all physician notes). These interfaces or information visualizations can be understood as an intermediate layer of information between very detailed information about the patient and overview information about all patients [10].

Tospra et al. studied different ways of designing interfaces providing an overview of the decision-making process for the prescription of antibiotics. They concluded that the interface designed according to usability principles was most popular among clinicians as opposed to the interface designed as a decision tree with the possibility to expand or contract information which was least popular [11]. The usability principles that guided the design of the interface were: (1) a reduction in the number of screens to facilitate navigation, (2) appropriate font sizes, acceptable contrast between text and background, and meaningful colors to improve readability, (3) organization of information to facilitate on-screen searches, (4) display of important information in more prominent positions, and (5) use of tables, graphs, buttons, scroll bars and iconic language to ensure that the information presentation is not to dense [11,p. 108]. The usability-based interface displayed all the knowledge required for antibiotic prescription in one screen. Clinicians found these interfaces easy to use; the language was clear, the information was presented effectively (the clinicians could see all possible alternatives before making a decision), and the reduction in the number of clicks required to navigate the interface meant the clinician could interact with it more efficiently [11].

It is difficult to strike the delicate balance between detailed information and overview when designing overview interfaces. Frost and Gabrielli studied an overview interface designed for clinicians on a psychiatric ward and found that the clinicians preferred not to have too much detailed information presented in the interface; however, at the same time, the clinicians requested that all the critical information about the patient be presented on one screen. They also discovered that the clinicians were uninterested in an adaptive system, but preferred a stable system that presented the same key information in the same interface on every occasion. Based on these findings, they designed an interface that comprised various relevant pieces of information in one stable set-up, and they tested this interface with clinicians. An important piece of feedback was the need to indicate the time at which the data were gathered, because, with no sense of a timeline, the clinicians found it difficult to create overview and make use of the available graphic presentations [10].

In contrast, Rooney et al. investigated the opportunity to rearrange or group information in new and personal ways to support the process of sense-making or the creation of overview among intelligence agents. They studied a system where the user was presented with an empty canvas and was able to initiate a search of keywords. The result of this search was presented as a visual cluster of index cards. The user could then select individual index cards and drag them to form user-defined clusters. This optional data ordering allowed the user to systematically review; elaborate and test his or her understanding of causal relations. In accordance with the